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Social functioning and subclinical psychosis in adolescence: a longitudinal general adolescent population study

Heins M, Achterhof R, Collip D, Viechtbauer W, Kirtley OJ, Gunther N, van Os J, Feron F, Myin-Germeys I. Social functioning and subclinical psychosis in adolescence: a longitudinal general adolescent population study

Objectives: To investigate the longitudinal relationship between subclinical psychotic symptoms and social functioning in a representative general population sample of adolescents.
Method: Data were derived from a routine general health screening of 1909 adolescents in a circumscribed region. Baseline measurement was in the second grade of secondary school (T0), and follow-up occurred approximately 2 years later (T1). Social functioning and subclinical psychotic symptoms of hallucinations and delusions were assessed at both time points.
Results: Baseline (T0) social problems preceded follow-up (T1) subclinical delusions, but not T1 subclinical hallucinations. Similarly, T0 delusions preceded social problems at T1, but T0 hallucinations did not.
Conclusion: This longitudinal general population study demonstrated a bidirectional association between social problems and delusions, but found no link between social problems and hallucinations. This may reflect a downward negative spiral where delusional thoughts and social problems reinforce each other.

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Key words: subclinical psychosis; delusions; hallucinations; social functioning; social cognition

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Significant outcomes:

- To our knowledge, this study is the first to report a significant bidirectional relationship between social functioning and subclinical delusions, in a general population of adolescents.
- The results did not reveal effects of subclinical hallucinations on social functioning, or vice versa, indicating that the potential negative spiral of social problems and psychotic symptoms might be unique for delusions.

Limitations

- Only a limited number of items were used for constructing the symptom and social variables. As a result, the sensitivity for detecting hallucinations might have been too low, as it was assessed by one single item that was endorsed by few participants.

Introduction

Psychotic disorder is associated with social isolation and alterations in social functioning. Cross-sectional studies show that problems in social functioning are a common feature of the disorder(1) and that social alterations are present at the time of onset.(2–4) However, the nature and temporal order of the relationship between social problems and psychotic disorder require further study.

Cross-sectional studies of adolescents and young adults at high risk for psychosis indicate poorer peer relationships and lower levels of social functioning compared to non-psychiatric controls.(5–7) Dworkin and colleagues reported that adolescent children of parents with a diagnosis of schizophrenia, who carry a genetic risk for psychosis and grow up in a potentially at-risk family environment, showed significantly worse social competence levels when compared to the adolescent children of non-psychiatric parents.(5) One review identified that in five birth-cohort studies, subtle and non-specific behavioural features during childhood, such as more solitary play, more peer rejection, and more social anxiety, preceded the later development of schizophrenia or schizophreniform disorder.(8) A large-scale study by Malmberg and coworkers found problems with interpersonal relationships at age 18 to be predictive of a diagnosis of schizophrenia 15 years later.(9) Three additional studies using a prospective approach found that the decline in social functioning preceded clinical psychosis in a sample of individuals with subclinical psychotic experiences(10–12); these studies concluded that decline in social functioning is a predictor of the *transition* from subclinical to clinical psychosis. Although these studies have focused on different aspects of social dysfunction (e.g., deficits in traditional social functioning, social anxiety, peer rejection), they all converge on the conclusion that social dysfunction in a broad sense is a prodromal or predictive factor in relation to the development of schizophrenia and other non-affective psychotic disorders.

Alternatively, social problems and loss of social relationships and support may also result from developing psychosis and/or the stigma associated with (early) psychosis.(13–15) In several studies that investigated the phenomenology and personal experiences of patients with schizophrenia by qualitative interview methods, patients reported that problems in social relationships mostly arose after the onset of psychosis.(16, 17) Notably, the relationship between social problems and psychotic experiences might also be related to the common link that they have to lower social cognition.(18–20)

These findings raise conflicting hypotheses regarding the temporal relationship between alterations in social functioning and psychosis; altered social functioning has been implicated as both a cause and a consequence of psychosis. Longitudinal general population studies are therefore required to clarify whether social problems precede or follow the onset of subclinical psychotic experiences, or both.

One longitudinal study in a general population adolescent sample by Collip and colleagues found that poorer interpersonal functioning at baseline was consistently associated with higher levels of bizarre experiences and persecutory ideation at later measurement points.(21) Interpersonal functioning and symptoms were both measured at multiple time points, but these effects were exclusively unidirectional.

Aims of the study

The current study aimed to examine the association between social alterations and psychosis in a large representative sample of adolescents in the general population, focusing on the question of whether general social problems precedes onset of subclinical psychotic symptoms or whether these symptoms precede general social problems, or both. Importantly, social problems may be due to both individual difficulties of engaging in social behaviour, and from being in a maladaptive social environment. Although many conceptualizations of social dysfunction assume an individual perspective, we focus on social problems in a broader sense.

Methods

Participants

All children in the Netherlands aged 4–16 years are examined regularly by the Youth Health Care Divisions (YHCD) of (Regional) Public Health Services. In the city of Maastricht and surrounding areas, parents of the younger children as well as adolescents aged 13 years and older are asked to fill in a questionnaire together with the medical examination. Health information aiming to detect and remediate physical and mental health problems as well as background characteristics (e.g., type of secondary education) was derived from this questionnaire, which was compiled in the context of an academic partnership between YHCD and Maastricht University, Maastricht, the Netherlands.(22, 23)

The present study used data from two waves of these Regional Profiles of Youth health (RPY), pertaining to 1912 adolescents living in Maastricht or surrounding areas (total population of 201 000) who were attending the second grade of secondary school (age 13/14 years: T0) and approximately 2 years later while attending the fourth grade (age 15/16 years: T1). As these data originated from all second- and fourth-year students in this region, the sample is fully representative of the population of Maastricht adolescents in this age range around this time. However, the gap between T0 and T1 varied across participants, with a minimum of 3 months and a maximum of 44 months between measurement points (first quartile = 15 months; median = 18 months; third quartile = 24 months).

Measures

Subclinical psychotic experiences. Self-reported auditory hallucinations at T0 and T1 were assessed with the single item: 'Have you ever heard voices other people cannot hear?' A 'Yes' or 'No' answer on this question constituted the hallucination measure where 'Yes' was scored as 1 (symptom present) and 'No' was scored as 0 (symptom absent). Delusional ideation at T0 and T1 was assessed with the following three questions: (i) 'Some people believe in mind reading or being psychic. Have other people ever read your mind?', (ii) 'Have you ever had messages sent just to you through television or radio?', and (iii) 'Have you ever thought that people are following you or spying on you?' These questions were derived from the Diagnostic Interview Schedule for Children (DISC-C)(24) for DSM-III (APA Diagnostic and Statistical Manual, 1980) and were formally validated by various groups.(25, 26)

However, the question about thought reading was not included in the analyses in the current paper, because 30% of all subjects at T0 and 33% at T1 answered 'Yes' to this question, which is much higher than would be expected on the basis of other studies.(27, 28) This question therefore lacked discriminative power in this sample. Affirmative or negative answers to the remaining two delusional ideation questions together constituted the delusion variable. 'Yes' to either of the delusional ideation questions was scored as 1 (presence of at least one symptom), and two 'No' answers was scored as 0 (absence of symptoms).

Social problems. Problems in social functioning at T0 and T1 were assessed with the following statements: 'I have feelings of loneliness', 'I have problems at school', 'I have problems with my parents', and 'I have problems with my friends'. These four items represent three distinctly different aspects of social functioning. Whereas problems with parents and friends assess social functioning directly, feelings of loneliness refer more to a subjective aspect of social functioning (the importance of the distinction between subjective and objective aspects of social functioning is discussed in Priebe(29)). In addition, problems at school are linked more strongly to role functioning rather than to social functioning.(30) All four problems in social functioning were rated as 'Yes' (=1) or 'No' (=0). Affirmative or negative answers to these four questions constituted the social problems variable, where 'Yes' to two, three, or four of the social problems questions was scored as 2 (2 or more problems present), 'Yes' to one of the questions was scored as 1 (1 problem present), and four 'No' answers was scored as 0 (problems absent).

Statistical analysis

Data were analyzed using binary mixed-effects and ordinal logistic regression models in STATA 13.1.(31) First, to investigate the association between baseline social problems and follow-up subclinical delusions and hallucinations, a mixed-effects (multilevel) logistic regression model was estimated. Follow-up (T1) delusions and hallucinations were the dichotomous dependent variables (0 = absent, 1 = present) and baseline (T0) number of social problems (0 = problem absent, 1 = one problem present, 2 = two or more problems present) was the independent variable, allowing for different coefficients for social problems on hallucinations and delusions. To account for the multilevel structure of the data (two outcomes nested within subjects), random intercepts at the subject level were included in the model. A Wald-type test was used to examine whether the coefficient for social problems on hallucinations differed from the coefficient for social problems on delusions.

Second, to investigate the association between baseline subclinical hallucinations and delusions and follow-up social problems, an ordinal logistic regression model was used. Follow-up (T1) number of social problems was the ordinal dependent variable, and baseline (T0) delusions and hallucinations were the dichotomous independent variables. A Wald-type test was again used to examine whether the coefficient for hallucinations on social problems differed from the coefficient for delusions on social problems. Furthermore, the proportional odds assumption underlying this model was tested using Brant's test.(32) A Bonferroni multiple

comparison correction was applied to these analyses, using an alpha value of 0.05/6 = 0.008, corresponding to six cross-lagged coefficients estimated.

A priori confounders included in all regression analyses were gender, educational level (as an indicator of socioeconomic status), and the T0 level of the outcome variable (either symptoms or social problems). These variables were included as gender was previously identified as a confounder in the similar study by Collip and colleagues,(21) and socioeconomic status likely affects both symptoms and social functioning. Educational level was divided into five categories (1: pre-university education, 2: higher general secondary education, 3: highest level of technical and vocational training for 12- to 16-year-olds, 4: medium level of technical and vocational training for 12- to 16-year-olds, and 5: lowest level of technical and vocational training for 12- to 16-year-olds) and was entered as a factor variable into the model.

Results

Sample description

The sample at baseline (T0) consisted of 1912 participants. Twenty-six participants had missing data on T0 psychosis items, 286 participants had missing data on the follow-up (T1) psychosis items, of nine participants sex was not recorded, and of 102 participants educational level was unknown, leaving a sample size of 1553 participants. Of the 1553 participants, 836 (54%) were female. A total of 23% of the participants attended school level 1, 16% school level 2, 28% school level 3, 22% school level 4, and 11% school level 5. Scores on the social functioning and psychosis measures at T0 and T1 are displayed in Table 1.

Additional analyses indicated that those 359 participants that were not included in the final sample were younger at baseline ($t(501) = 4.26$, $P < 0.001$), were older at follow-up ($t(582.5) = -9.57$, $P < 0.001$), and had slightly lower education levels ($X(4, 1810) = 153.56$, $P < 0.001$). They also reported more hallucinations ($X(1, 1896) = 4.78$, $P = 0.03$) and social problems ($X(2, 1910) = 30.85$, $P < 0.001$) at baseline, and more delusions at follow-up ($X(1, 1668) = 17.37$, $P < 0.001$). This indicates that non-responding was non-random and that within the sample that was used, maladaptive outcomes might have been underreported.

Table 1. Symptom scores and social problems at baseline (T0) and follow-up (T1) of all $n = 1553$ participants

Symptoms and problems		Endorsement
T0 delusions		$n = 222$ (14%)
T0 hallucinations		$n = 74$ (5%)
T1 delusions		$n = 235$ (15%)
T1 hallucinations		$n = 63$ (4%)
	Endorsement of one	Endorsement of two or more
T0 social problems	$n = 91$ (6%)	$n = 41$ (3%)
T1 social problems	$n = 85$ (5%)	$n = 26$ (2%)

Analysis of social problems as predictor of subclinical psychosis symptoms

Mixed-effects (multilevel) logistic regression modeling showed that the number of social problems at T0 was associated with follow-up (T1) delusional ideation, while correcting for gender, educational level, and T0 delusional ideation (OR = 2.15, $P < 0.001$, 95% CI: 1.40, 3.30).

On the other hand, the association between follow-up (T1) hallucinations and the number of social problems at T0 was not significant (OR = 0.82, $P = 0.516$, 95% CI: 0.45, 1.49), while correcting for gender, educational level, and T0 hallucinations.

Postestimation analysis confirmed that the association between baseline social problems and follow-up delusions was significantly stronger than the association between baseline social problems and follow-up hallucinations (ratio of ORs = 2.63, $P = 0.005$, CI: 1.34, 5.14).

Analysis of subclinical psychosis symptoms as predictors of social problems

Ordinal logistic regression analysis, investigating the effect of T0 delusional ideation and hallucinations on social problems at T1 (while correcting for social problems at T0 as well as gender and educational level), found follow-up (T1) number of social problems to be associated with baseline (T0) delusional ideation (OR = 2.65, $P < 0.001$, 95% CI: 1.68, 4.17; Fig. 1). On the other hand, the effect of T0 hallucinations on social problems at T1, while correcting for social problems at T0 as well as gender and educational level, was not significant (OR = 1.03, $P = 0.94$, 95% CI: 0.49, 2.19; Fig. 1). There was no evidence of the proportional odds assumption being violated in this model ($\chi^2 = 6.18$, df = 8, $P = 0.63$).

The association between baseline delusions and follow-up social problems was found to be stronger than the one between baseline hallucinations and follow-up social problems (ratio of ORs = 2.57; CI: 0.97, 6.82), but fell short of being statistically significant at $\alpha = 0.05$ ($P = 0.058$). We

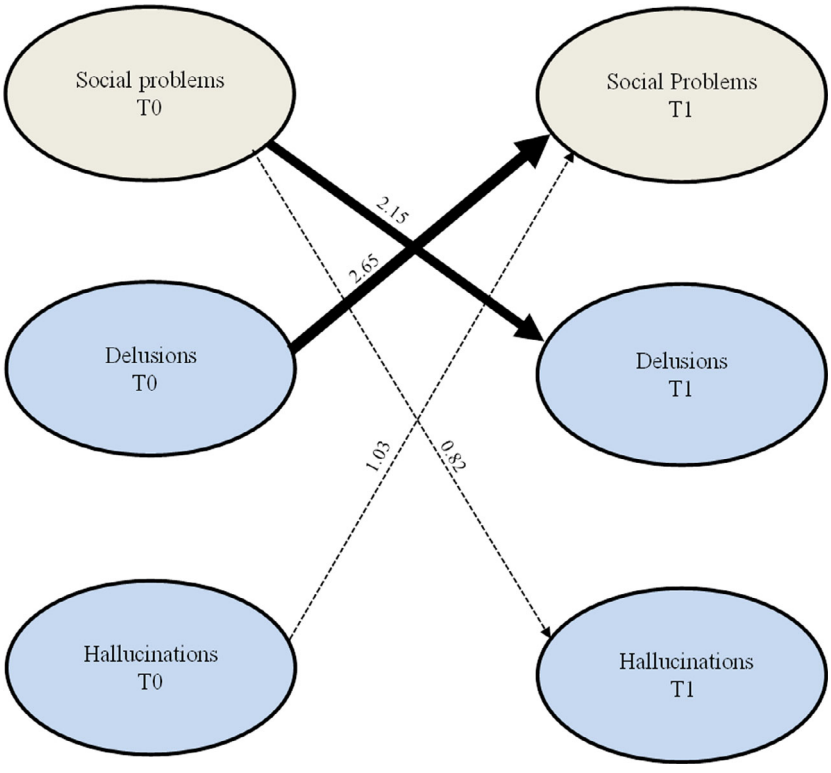

Fig. 1. Longitudinal associations between social functioning and subclinical delusions and hallucinations. Note: Significant ($P \leq 0.008$) pathways are displayed by continuous line arrows and non-significant pathways by broken line arrows. Thickness of the line represents the strength of the association; the thicker the line, the stronger the association. Each model was adjusted for sex, level of education, and T0–T1 associations within variables (e.g., T0 social problems was corrected for in the prediction model of T1 social problems).

also conducted a post hoc analysis to investigate whether in the current sample the predictive value of delusions to social problems could be better or partially explained by their mutual dependence on emotional problems. Therefore, baseline depressed mood (assessed with 1 item: 'I am concerned about having low mood and I would like to talk to the nurse about it'; scored 'yes'/'no') was included in the model. Adding this variable did not result in any change in both the strength and the significance of the association between delusions and social problems, which was still significant (OR = 2.65, $P < 0.001$, 95% CI: 1.68, 4.17).

Discussion

The current study investigated the longitudinal, bidirectional relationship between subclinical psychosis symptoms and social functioning in a representative general adolescent population sample. Analyses showed that social problems are a predictor of later subclinical delusions, but not hallucinations. Similarly, subclinical delusions, but not hallucinations, are associated with later social problems.

Prediction of psychotic experiences by social problems

The finding that poor social functioning is associated with later delusional ideation is in line with previous research suggesting that poor social functioning precedes the onset of psychotic symptoms or transition to psychotic disorder,(1, 33–35) although we did not find an association with later hallucinations. Most previous studies did not distinguish between the different symptoms of psychosis. The few studies that did differentiate between delusions and hallucinations found similar results to what is reported in the current study. One cross-sectional study in patients with a psychotic disorder found that paranoid ideation and so-called 'first-rank delusions' (generally referring to delusions of thought control) were associated with social functioning, whereas there was no significant association present for 'first-rank hallucinations' (generally referring to auditory hallucination).(36) A longitudinal study by Collip and colleagues distinguished between four symptom domains.(21) Similarly to the current study, they found poor interpersonal functioning to be predictive of later bizarre experiences and persecutory ideation, but not of perceptual abnormalities.

Prediction of social problems by psychotic experiences

The association between subclinical delusional ideation and poor social functioning in the current study was found to be bidirectional; subclinical delusions also predicted a decline in social functioning. These findings seem to contradict the

findings of two recent longitudinal studies. One study in patients with first-episode psychosis did not show an association between psychosis symptoms and social functioning over time,(37) whereas another general population study found none of the subclinical psychosis symptoms to predict interpersonal functioning over time.(21)

On the other hand, clinical findings do support a decline of social functioning in the early phase of schizophrenia(4, 38) and in subjects at ultra-high risk and in the conversion stages toward psychosis.(39) Two longitudinal studies examined social functioning over a 12-month period in adolescents with subclinical psychotic symptoms(40) and first-episode psychosis patients.(41) Both studies reported an association between baseline psychotic symptoms and follow-up social functioning. However, in both studies the association was partially explained by other variables, such as cognitive alterations and emotional problems. We tested whether controlling for emotional problems (in the form of depressive symptoms) affected the significance of the relationship between baseline delusions and follow-up social problems—which did not happen. Furthermore, Asher and colleagues did find tentative support for a causal role for psychosis to a decline in social functioning as evidenced by a dose–response relationship.(40)

The nature of the relationship between social problems and delusions

The bidirectional relationship between social problems and delusional ideation found in the current study reflects the dynamic interaction between the social environment and psychosis. We will discuss two possible explanations for the observed bidirectional association. The first explanation is that both delusional ideation and social problems may result from a common underlying mechanism. It has been hypothesized that pathogenic neurodevelopmental processes (e.g., resulting from birth asphyxia) that increase vulnerability for psychosis may also impair the development of social skills needed for healthy social functioning. Especially social cognition impairments are found to be associated with functional (social) outcome in psychosis in several reviews.(18–20) However, whether social cognition impairments have a direct impact on functional outcome or whether the association is explained by psychosis symptoms remains unclear.(42–44) A second explanation for the bidirectional *longitudinal* relationship is that delusional ideation and social problems causally interact even if both are linked to social cognition alterations. Delusional ideation may directly give rise to more social problems and vice versa. Delusional ideation has been found to lead to social avoidance and isolation in non-clinical studies.(45, 46) Delusions may increase social problems simply by making someone less inclined to socially interact with them due to suspiciousness or mistrust, leading to more problematic relationships with family and peers and at school. In one study, participants high in non-clinical paranoia reported fewer social contacts and a reduced tendency to engage others in social conversation compared to the low paranoia group.(47) Avoidance of others, on the other hand, may in turn reinforce paranoid ideation and prevent a disconfirmation of those paranoid beliefs.(48, 49) Social problems may thus increase paranoid ways of thinking by lack of reality monitoring in social settings. Adolescents with social problems and proneness to delusional ideation thus may find themselves on a negative downward spiral with social functioning and occurrence of delusions both negatively impacting on one another.

Limitations and strengths

The results of the current study should be interpreted taking into account its limitations and strengths. First, the absence of an association between hallucinations and social problems may be the result of insufficient sensitivity of the hallucinations measure compared to the delusions measure. Hallucination occurrence was assessed by a single question (resulting in relatively low sensitivity), while delusional ideation was assessed by three questions, and in the current sample, hallucinations had lower prevalence (T0 hal = 5%, T1 hal = 4%) than the delusions measure (T0 del = 14%, T1 del = 15%). However, it is also worth noting that one validation study found that out of a set of screening items, the single hallucination item that we used had the best predictive power for interview-confirmed hallucinations and psychotic-like experiences.(25) Second, the measurement of social problems was suboptimal, as items were not part of a validated measure of social functioning. Also, when compared to similar Dutch studies, there was a relatively low endorsement of social problems in this sample.(50, 51) Although we have no information on this, this might reflect a general unwillingness to indicate problems caused by the fact that adolescents would first meet a youth mental health professional only after filling out the questionnaires. Keeping these limitations in mind, however, strengths of the study include the large sample size and representativeness of the sample. First, data were retrieved

from a general health screening regularly conducted in all schoolchildren in the Netherlands, thus including all educational levels and all socioeconomic backgrounds. Second, social problems was examined in a broader way than in some of the previous studies mentioned above (by assessing aspects of both subjective and objective functioning, and items pertaining to both role and social functioning). Third, in the current study subclinical psychosis was not investigated as a single construct, but its different symptoms were investigated separately, revealing the difference between delusions and hallucinations in their associations with social functioning.

In conclusion, the current study lends further support for the link between subclinical psychotic delusions and social problems and provides evidence for the bidirectional nature of this relationship. No such relationship was found for hallucinations and social problems. This study is the first to indicate in a representative general population adolescent sample that subclinical delusions predict poor social outcomes. This is highly relevant, as it highlights how social dysfunction might be a driving force behind the initial development and subsequent maintenance of delusions. These findings may reflect a downward negative spiral of delusions and social problems, in which both are exacerbated through time. In order to foresee and potentially prevent the development of clinically relevant delusions, researchers and clinicians should be aware of this potential negative spiral.

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Declaration of interest

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